lero THE IRISH SOFTWARE ENGINEERING RESEARCH CENTRE

systems perspective

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Research Area	GSD
Project Title	Agile software development

1. Agile Software Development (ASD)

- **Agile methods: XP, Scrum…**
- **Agile values and principles: the Agile Manifesto**
- **Theoretical basis of ASD: Complex Adaptive Systems perspective (CAS)**

2. Research Question

How to organize a software development process to be agile from a Complex Adaptive Systems perspective?

3. Literature

Theoretical studies

Category	Studies	Theory used	Research method
Explaining or re-organizing agile methods by frameworks	Wendorff 2002a	Systems thinking	----
	Kalermo and Rissanen 2002	----	Literature review + a case study
	Kuhkonen and Abrahamsson 2003	S-A knowledge creation model	Literature review
	Visconti and Cook 2004	----	Literature review
	Lindstrom and Jeffries 2004	----	Literature review
	Vanderburg 2005	----	----
	Augustine et al. 2005	Complex Adaptive Systems	Own experience
	Meso and Jain 2006	Complex Adaptive Systems	Literature review
Exploring underlying assumptions	Wendorff 2002b	layered conceptualisation of organisational culture	Literature review
	Turk et al. 2002	----	Literature review
Defining agility	Conboy and Fitzgerald 2004	----	Literature review
	Lyytinen and Rose 2006	Exploration and exploitation (March 1991)	Longitudinal multi-site case study
Other studies	Auer et al. 2003	----	----
	West 2001	----	----

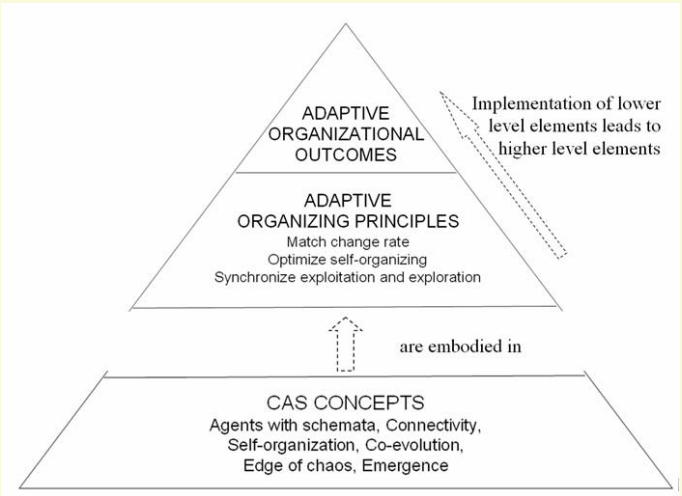
Empirical studies

	Empirical studies of agile processes	Agile methods (practices) studied	Theory or framework used
Studies at the method level	Dall'Agnol et al. 2004	General agile methods	----
	Abrahamsson and Koskela 2004	XP	----
	Sharp and Robinson 2004	XP	----
	Svensson and Host 2005	XP	----
	Sfetsos et al. 2006	XP	Systems thinking
	Dingsoyr et al. 2006	Scrum	----
Studies at the practice level	Fruhling and De Vreede 2006	All XP practices	----
	Farrith et al. 2004	Pair programming, XP	----
	Hulkko and Abrahamsson 2005	Pair programming, XP	using existing empirical results as a framework
	Auvinen et al. 2006	pair programming, XP	----
	Salo et al. 2004	Post-iteration workshop, XP	----
	Fitzgerald et al. 2006	XP and Scrum practices	Method tailoring

Knowledge gaps:

- **A consistent and consensus understanding of agile methods is yet to be achieved**
- **Studies consolidating the theoretical basis of agile methods are conceptual, being focused on the abstract forms of agile methods. The frameworks they used and the results they achieved have not been evaluated and validated in real-world settings; and**
- **Empirical studies are neither very systematic nor guided by appropriate theories or frameworks.**

4. Theoretical Framework



5. Empirical Study

- **Multiple-case study approach**
- **Software development teams using agile methods have been studied**
- **Qualitative data analysis**

6. Findings

CAS-based organizing principles	Adaptive organizing principles in software development
Principle 1: Match change rate	- Driven by evolving business values o An evolving view on user requirements o A close relationship with customers o Customer value driven - Time pacing in a sustainable way o Pacing software development by time o Maintaining a sustainable pace o Regular break and closure from time pacing o Holding a whole picture of the project - Frequent and fluid planning o Planning often, planning for short terms, and adjusting plans constantly o Working at a fine level of granularity
Principle 2: Optimize self-organizing	- Self-managing with discipline o Internalizing project management, and relying on people o Peer- and self-discipline - Team interacting with supporting structures
Principle 3: Synchronize exploitation and exploration	- Reviewing process regularly - Routinizing exploration

CAS-based outcomes	Adaptive organizational outcomes in software development
Co-evolution of team and customer	- Deep understanding of user requirements - Quick and frequent bi-directional feedback - Customer steering development
Stability for development	- Short-term certainty - Accurate estimates - Team being satisfied, motivated and focused - Working at a sustainable pace
Embraced uncertainty	- Probability to change directions - A whole picture of the project
Autonomous team	- Distributed competences - Disciplined team
Sharing	- Knowledge sharing - Context sharing - Collective ownership of results
Team learning	- Learning continuously, mutually and gradually
Collective creativity	- Emergent new ideas, quick problem solving or innovative use of practices
Other adaptive outcomes	- An emergent rhythm for working - Emergent teamness - Formality of process - Assimilation of practices

NDP NATIONAL DEVELOPMENT PLAN

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